

WHAT IS CLAIMED IS:

1. A method for hole-filling in 3D models, comprising the steps of:

5 identifying vertices adjacent to hole boundaries in a mesh of points on a digital image;

constructing a signed distance function based on vertices adjacent to hole boundaries;

fitting a Radial Basis Function based on the constructed signed distance function;

10 evaluating the fitted Radial Basis Function on a grid including the hole; and

extracting and meshing the points on the hole surface to fill the hole.

15 2. The method as recited in claim 1, further comprising the step of generating a mesh using points of an image.

20 3. The method as recited in claim 2, further comprising the step of scanning an image using a Ball Pivoting Algorithm.

4. The method as recited in claim 1, further

comprising the step of listing and indexing holes in the
mesh.

5. The method as recited in claim 1, further
comprising the step of scanning an object to generate the
mesh.

6. The method as recited in claim 1, wherein the
step of identifying vertices adjacent to hole boundaries
10 includes employing a search algorithm.

7. The method as recited in claim 1, wherein the
search algorithm includes employing a breadth first search.

15 8. The method as recited in claim 1, wherein the
step of constructing a signed distance function includes:
defining a distance function d for additional points,
which lie on surface normals from vertices;
evaluating a continuous distance function on a grid.

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9. The method as recited in claim 7, wherein a
value of a distance d between each additional point and its
associated vertex controls a topology of an output surface,

and further comprising the step of defining the value of distance d by a user.

10. The method as recited in claim 7, wherein a resolution of the grid defines the detail of generated surfaces, and further comprising the step of defining the resolution of the grid by a user.

11. The method as recited in claim 1, wherein fitting a Radial Basis Function based on the constructed signed distance function includes solving a set of simultaneous equations given by Equation 6.

12. The method as recited in claim 1, wherein the step of extracting is performed by a zero crossing method.

13. A system for hole-filling in 3D models, comprising:
a storage device, which stores a digital form of an image;
a processor, which graphically renders the image on a graphics subsystem;
the system further comprising a program which

identifies points in the image and integrates a mesh between these points to define vertices adjacent to hole boundaries in the mesh, the program further comprising:

5 a signed distance function which is constructed based on vertices adjacent to hole boundaries;

10 a Radial Basis Function which is fitted based on the constructed signed distance function, the Radial Basis Function being evaluated on a grid including one of the holes such that the hole is filled by extracting and meshing the points of the hole surface.

14. The system as recited in claim 13, wherein the mesh is generated using points of an image.

15 15. The system as recited in claim 13, further comprising an image acquisition device, which scans a digital image of an object to be modeled.

20 16. The system as recited in claim 13, wherein the program employs a Ball Pivoting Algorithm in scanning an image.

17. The system as recited in claim 13, wherein the

program identifies vertices adjacent to hole boundaries by employing a search algorithm.

18. The system as recited in claim 17, wherein the
5 search algorithm includes a breadth first search.

19. The system as recited in claim 13, wherein the signed distance function includes values of distances between additional points located on a surface normal from 10 associated vertices, the values of distances to control a topology of an output surface.

20. The system as recited in claim 19, wherein the values of distances are user defined.

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21. The system as recited in claim 13, wherein a resolution of the grid defines the detail of generated surfaces.

20 22. The system as recited in claim 21, wherein the resolution of the grid is user defined.

23. The system as recited in claim 13, wherein the

Radial Basis Function includes the form of $s(x)$ in Equation 4.

24. A program storage device readable by machine,
5 tangibly embodying a program of instructions executable by the machine to perform method steps for hole-filling in 3D models, the method steps comprising:

identifying vertices adjacent to hole boundaries in a mesh of points on a digital image;

10 constructing a signed distance function based on vertices adjacent to hole boundaries;

fitting a Radial Basis Function based on the constructed signed distance function;

evaluating the fitted Radial Basis Function on a grid 15 including one of the holes; and

extracting and meshing the points on the hole surface to fill the hole.

25. The program storage device as recited in claim 20, further comprising the step of generating a mesh using points of an image.

26. The program storage device as recited in claim

24, further comprising the step of listing and indexing
holes in the mesh.

27. The program storage device as recited in claim
5 24, wherein the step of identifying vertices adjacent to
hole boundaries includes employing a search algorithm.

28. The program storage device as recited in claim
24, wherein the step of constructing a signed distance
10 function includes:

defining a distance function d for additional points,
which lie on surface normals from vertices;
evaluating a continuous distance function on a grid.

15 29. The program storage device as recited in claim
28, wherein a value of a distance d between each additional
point and its associated vertex controls a topology of an
output surface, and the value of distance d is defined by a
user.

20 30. The program storage device as recited in claim
28, wherein a resolution of the grid defines the detail of
generated surfaces, and the resolution of the grid is

defined by a user.

31. The program storage device as recited in claim
24, wherein fitting a Radial Basis Function based on the
5 constructed signed distance function includes solving a set
of simultaneous equations given by Equation 6.